



CS Bits & Bytes is a bi-weekly newsletter highlighting innovative computer science research. It is our hope that you will use CS Bits & Bytes to engage in the multi-faceted world of computer science to become not just a user, but a creator of technology. Please visit our website at: <http://www.nsf.gov/cise/csbytes>.

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Navigating a 3D World

Computers can help people to navigate their world. Think of situations where a person might have difficulty navigating through their environment. These could be due to the dangerous nature of the environment (such as a disaster zone), a remote location (such as Mars), or because of a physical limitation (such as a sports injury or visual impairment). With recent advancements, robots can be designed to provide assistance in those areas. Not only can robots get into and out of those difficult spaces, but they can become, in essence, a personal fetch-and-carry robot.

MUST SEE!



Check out this feature on Professor Howard to learn what ignited her interest in robots

<http://pbskids.org/dragonflytv/scientists/scientist26.html>

through the stylus while controlling the robot. For example, the stylus stiffens as they approach a barrier. The operator can control the robot to avoid collision with any obstacles in the world or choose to just explore and feel the environment. The combination of the 3-D map and the haptic representations enable people to manipulate the robot in a more fluid and smoother fashion. Further, people with visual impairments can use the haptic feedback to create mental maps that can be applied in the real world, thus increasing familiarity of environments for venturing out on their own.



Professor Ayanna Howard with her invention the SnoMote.

Who thinks of this stuff? Professor Ayanna Howard founded the Human-Automation Systems (HumAnS) Laboratory at the Georgia Institute of Technology. She grew up in California, attended Brown University and received her doctorate from the University of Southern California. Ayanna's research spans the field of robotics, from using robots to help people with disabilities to bringing robots to glaciers to help detect climate change. Much of her research and outreach efforts are funded by The National Science Foundation. In her spare time, Ayanna enjoys watching science-fiction movies, teaching aerobic exercise classes, and traveling with her family.

How it's done! Computer Engineers and Scientists at the Georgia Institute of Technology have created a system where specialized cameras capture images of the environment. The system then constructs a 3D model of the environment that can be expressed and controlled in a multitude of ways: visual, audio, or haptic. Haptic techniques provide touch-based sensing and control of the environment. Visual images of the world are converted into haptic representations to allow a user to feel their environment without being there.

The system includes a robot that navigates the real-world environment and gathers spatial characteristics of the environment with sensors and conveys that information to the user. The human operator gains environmental perception through feedback forces that are transferred



The mobile manipulation robotic system in a real world environment.



Haptic Exploration with Mobile Manipulator (HEMM) system with a simulated environment.

In celebration of Black History Month, please take time to learn about other inspirational African American computer scientists! The Coalition to Diversify Computing (CDC) created a brochure about African American Female Computer Scientists available at: <http://www.cdc-computing.org/programs/current-programs/womenofcolor/>

Links:

To learn more about Professor Howard, visit:

<http://sse.jpl.nasa.gov/people/profile.cfm?Code=HowardA>.

To learn more about virtual maps for the blind, go to:

<http://www.sciencedaily.com/releases/2009/09/090910114152.htm>.

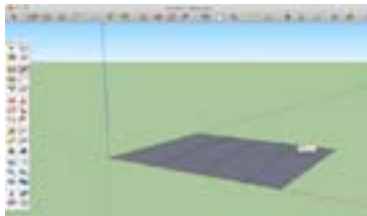
To learn more about physical activity and games for visually impaired persons, visit:

<http://vifit.org/>.

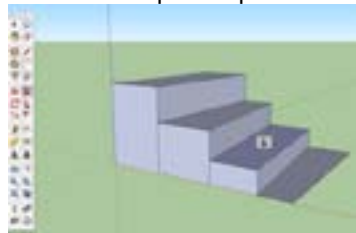
Computer Software Activity (This is a fun activity, but requires a small download, so perhaps is best done at home).

To introduce the idea of how researchers create a 3D environment, the students will build their own 3D model using Google SketchUp. The following steps guide you through an example. Students are challenged to explore and be creative!

1. Go to <http://sketchup.google.com/>.
2. Download Google SketchUp. Follow the on screen instructions. If needed, there are many tutorials on the web about how to download software.
3. There are several tutorials for new SketchUp users located at http://sketchup.google.com/training/videos/new_to_gsu.html. The first tutorial gives a great overview of the power of the software and how to use it.
4. Begin by selecting Simple Template – Feet and Inches, then go to view and make sure large tools are checked (from the tool palettes menu). Click on the eraser tool (if you can't find it on the left tool bar, you can select it from the Tools Menu). Remove the person from your workspace.
5. Click on the rectangle tool. Move your cursor to find the origin (intersection of three axes). Create a rectangle.
6. Using the pencil tool, start on one side of the rectangle and create a staircase by creating 5 lines from endpoint to endpoint. Repeat this process again. Make a line to close each end so that the shape is solid/enclosed.



7. Select the push up tool and click on a region to push it up into a third dimension.



8. Now that you have used the software a bit, pick an object (perhaps the chair you are sitting on) and model it!

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